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TECHNICAL NOTES

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Some Effects of Temperature Extremes on Saratoga Spittlebug Populations

The Saratoga spittlebug, first reported as a plantation pest in Wisconsin and Lower Michigan in 1941, is one of the most important insects affecting young red pine plantations in the Lake States. Damage is caused by adult feeding on the needle-bearing branches, resulting in necrotic scars in the cortex, twig mortality, and eventually death of the tree. Until the trees are about 15 feet tall a constant vigil must be kept by forest managers to detect potentially dangerous infestations. Control needs are estimated a year in advance on the basis of adult populations. Sometimes, however, the predicted and actual control needs differ considerably. This Note presents some clues as to the possible reasons for discrepancies in 1956 and 1957.

Early investigators learned through laboratory experiments that young spittlebug nymphs were killed by momentary direct exposure to temperatures in the low 20's (Fahrenheit). Such temperatures are not uncommon in the northern Lake States areas during May; where they persist long enough to penetrate the duff it is likely that spittlebug populations will be decimated. On May 16, 1957, temperatures in the low 20's and lower were recorded in the northern part of Wisconsin and in Upper Michigan. In the southern portion of the Nicolet National Forest below the dotted line in figure 1, temperatures did not reach these lethal levels. In the northern hard-freeze area, including the Chequamegon, Ottawa, and Upper Michigan National Forests, the nymphal population dropped to levels much lower than were predicted from the 1956 adult surveys (fig. 2, 1957 data) whereas in the southern portion of the Nicolet the populations remained at the expected level. It is suggested therefore that the population drop to levels not requiring control measures on about 6,000 acres of plantations in the more northerly area was due to early instar nymphal mortality during late spring freezes.

More specific data concerning the effect of the other temperature extreme were gained in 1956 from permanent study plots. It was found that periods of abnormally hot dry weather can also cause considerable nymphal mortality. Table 1 summarizes the differential effect of 4 days of such weather on the nymphs in 2 relatively open plantations and 2 well-stocked, heavily shaded plantations. No significant biological control factors were found in any of the plots, and it is tempting to speculate that the population drops in the northern area in 1956 (fig. 2) were due to desiccation during the heat wave. Many of the plantations in the northern forests are relatively more poorly stocked and exhibit more frequent "frost pocket" failures, whereas a more benevolent climate on the Nicolet National Forest tends to promote more rapid growth with denser ground cover.

Although adequate data are not available to afford definite proof, it seems likely that the weather factors mentioned may have been responsible for reducing spittlebug populations in 1956 and 1957 and thus eliminating the need for spraying considerable areas on the National Forests, which had originally been set up for control operations.

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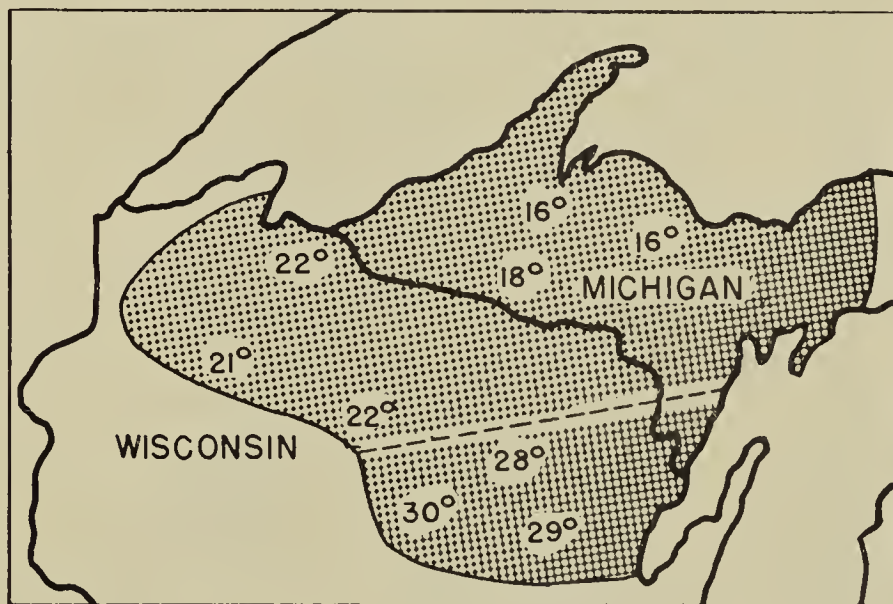


Figure 1.--Minimum temperatures on May 16, 1957, in the spittlebug infested area of northern Wisconsin and Upper Michigan.

Table 1.--Nymphal mortality in open and shaded plantations during 4 days of hot dry weather, northern Wisconsin - June 1956

Stand density	No. of tree units per acre ^{1/}	Av. daily max. temperature June 10-13 ^{2/}	Nymphal sampling date	Nymphs per 1/10 milacre		Percent of initial population
				Av. no.	Standard error	
Well stocked, heavily shaded	107,163	91	June 5	6.2	±1.2	--
			June 13	5.5	±1.3	89
	71,285	93	June 5	4.9	±1.5	--
			June 13	4.9	±2.1	100
Relatively open	22,441	90	June 5	8.3	±2.9	--
			June 13	1.6	±1.0	19
	54,220	90	June 5	14.2	±2.5	--
			June 13	1.9	±0.9	13

^{1/} Measure of tree size and stocking (a product of average tree height (in feet), average number of branch whorls, and number of stems per acre).

^{2/} From Climatological Data, Wisconsin; U. S. Dept. Commerce Weather Bureau, LXI (6), June 1956.

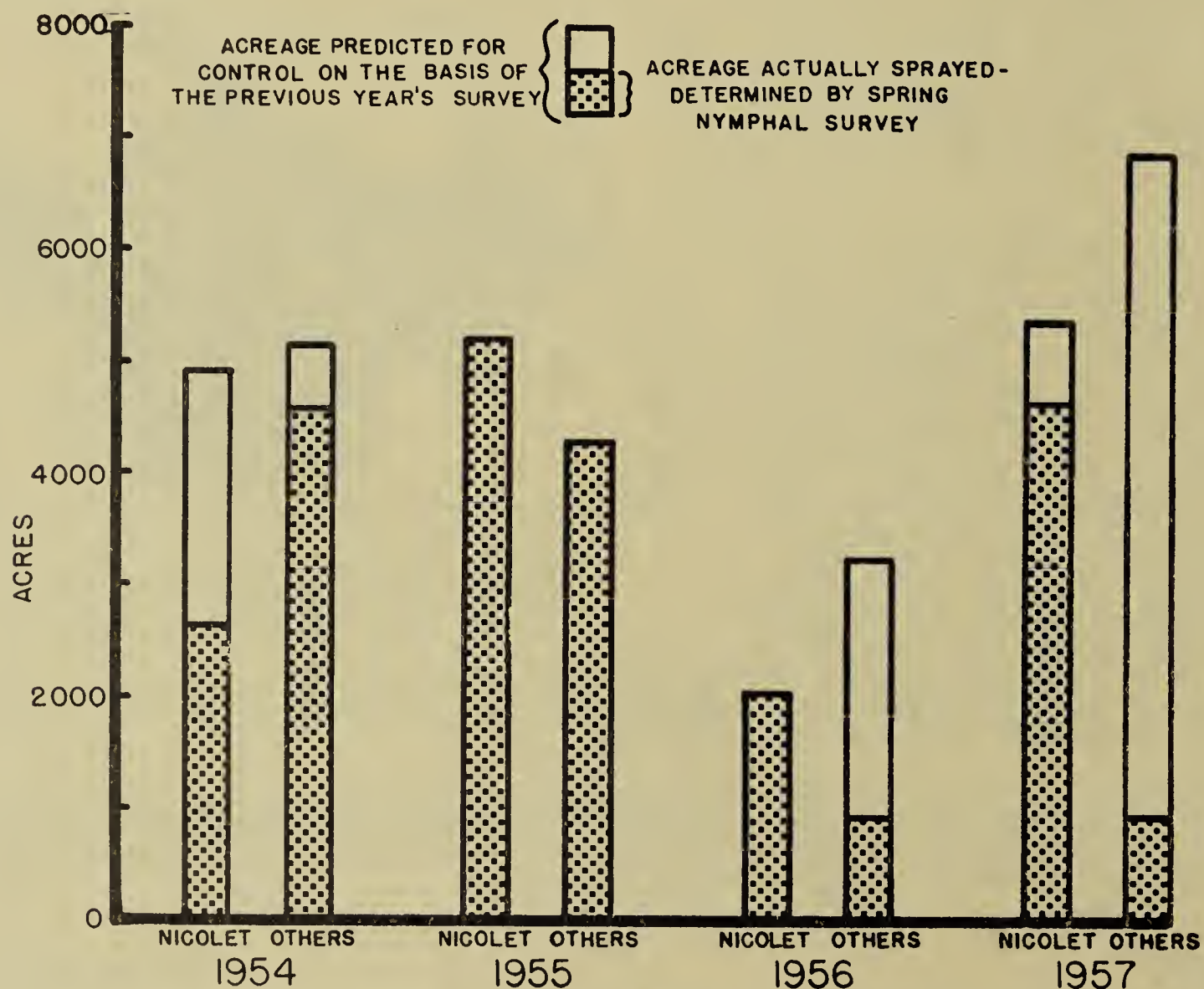


Figure 2.--Acreage predicted for control and acreage actually sprayed on the Nicolet National Forest and other National Forests in Wisconsin and Upper Michigan.